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Command Process Model

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ADMINISTRATIVE INFORMATION

The work reported herein was conducted for the Deputy Chief of Naval Operations (Naval Warfare) during FY 90 as part of the Naval Warfare Analysis Program. This document presents the results of a collaborative effort involving Science Applications International Corporation (SAIC) and Naval Ocean Systems Center (NOSC), Code 171, Systems Analysis Group, personnel.

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SECTION 1.0 INTRODUCTION

The purpose of the Command Process Model presented in this document is to provide guidance for the specification of the Top Level Warfare Requirements and for the assessment of Navy Command, Control, Communications, and Intelligence (C³I) Systems. It also provides an analysis framework for the Warfare Systems Architecture and Engineering Directorate of the Space and Naval Warfare Systems Command (SPAWAR) for use in the system engineering process.

The Command Process Model, defined in Appendix A, is the result of an evolution of the previous model, described in the Command, Control, Communications, and Intelligence Operational Requirements Framework document of July 1988 (reference (a)).

An overview of all the Command Functions is presented in section 2.0. This discussion provides a perspective on the relationship of the functions among themselves and to the operations they control. These functions were derived from other models of the decision process and consolidates important features of those concepts. A discussion of those features is provided in section 3.0 to highlight those aspects of the Command Functions and to explain the role of those features in the structure of the decision process. Section 4.0 concludes with a summary of highlights of the Command Process Model.



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SECTION 2.0 OVERVIEW OF COMMAND PROCESS MODEL

The Command Functions consist of four major functions: Plan, Observe, Assess, and Execute, sometimes abbreviated as POA&E. These one-word function names are used for ease of discussion. The four functions are almost identical with the functions of the Command Process Model in the previous OPNAV C³I Operational Requirements Framework document, except as noted below and in Appendix A. Additional functions of Sense and Act may be appended to the list to couple the other four to the physical world. The alternative functions of Receive and Issue (or Send) play a similar role in coupling to other decision-making activity.

The revised Command Process Model is depicted in Figure 1, Command Process Model. The decision process, the heart of the Command Functions, is in the center, with the coupling functions around it. The left side collectively performs monitoring activities, while the right side constitutes the control portion. The main sequences of the decision process are shown by arrows. Information flows among the decision functions are not shown, but they are listed in the appendix.

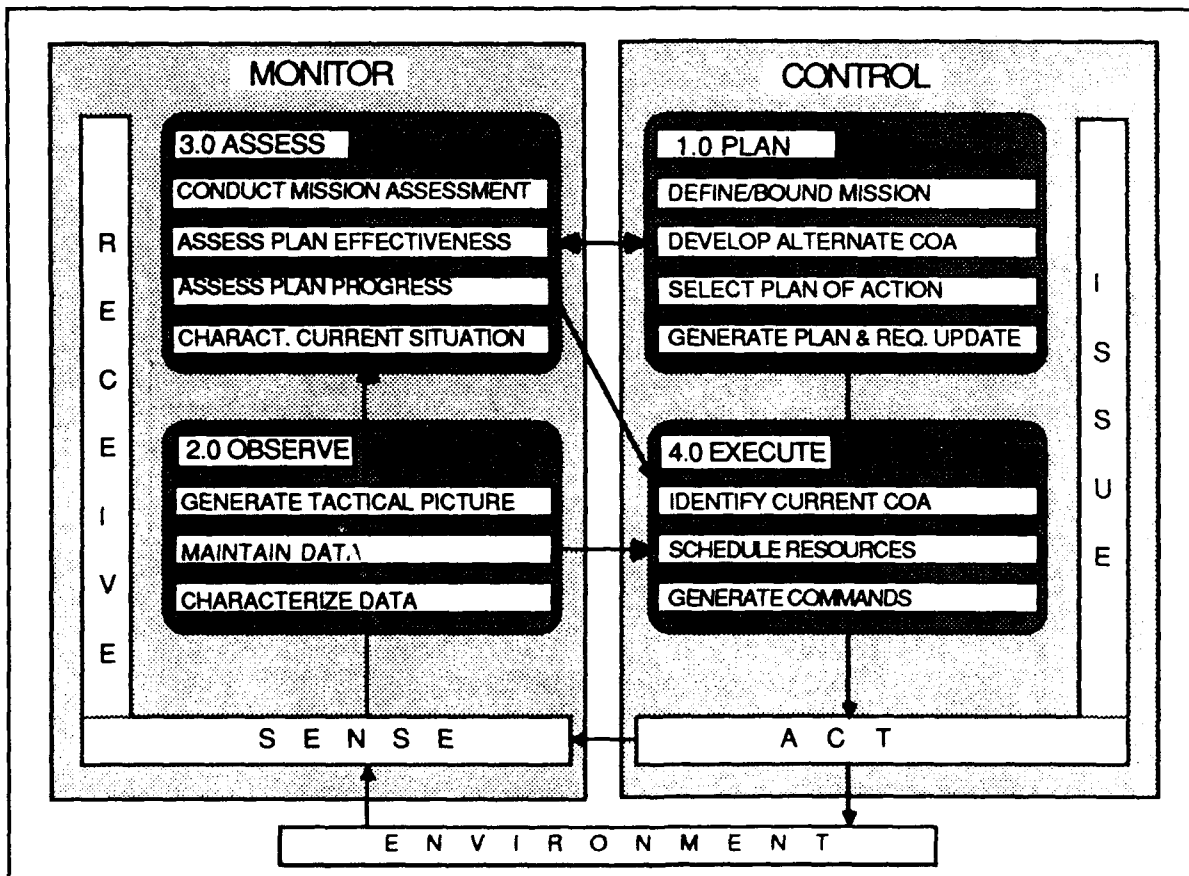


Figure 1. Command Process Model

Information obtained through the Receive function can be destined for any of the decision functions. In the appendix, these data are listed with the corresponding decision function. Information can also be obtained from the Sense function as an input to Observe. Information is transferred through the Issue function. This information is listed with the decision function which produces it. Actions being controlled are defined in the Act function. These actions include control of the sensing function, which produces sensory inputs. It is not critical whether Sense/Receive is viewed as a single function or as two functions; likewise for Issue or Act. However, there is a subtle difference, so these functions are shown separately.

2.1 PLAN

The Plan function generates optional courses of action intended to achieve the mission. Based on the same kind of assessment that the Assess function produces about projected mission achievement (see section 3.0 of Appendix A), the Plan function evaluates and selects primary and contingency courses of action, including organizational responsibility, procedures, and allocation of resources to general task areas. The criteria for assessing situations and changing procedures are defined by Plan for use in Assess in determining when these conditions exist. The procedures, including rules for allocating resources, are used by Execute to implement the plan and control its progress.

2.2 OBSERVE

The Observe function combines information for use by other functions. Observe is an all-encompassing "data fusion" function. It involves not only storing data together, but also association, correlation, and tracking functions and compilations of Intelligence data and Force status information. This aggregate of information is often referred to as the tactical picture at the combat level.

2.3 ASSESS

The Assess function makes use of the combined data to infer meaning about the situation, including enemy intent and potential outcomes of unfolding events. This inference is the real product of Situation Assessment, not just the tactical picture produced by Observe. The assessment determines whether mission objectives are being achieved, a new or revised set of plans is required, or a change of procedure under current plans is appropriate. If planning is required, the Plan function is invoked. If a change in procedure is suggested by the situation, the Execute function is notified and can change modes. Otherwise, execution proceeds under the current mode, using information from Observe.

2.4 EXECUTE

The Execute function selects a specific course of action, based on the current assessment of the situation (from Assess). Using procedures established in the plan and data from Observe, specific allocation of resources and tasks or even specific guidance variables are generated as directives and issued as orders or implemented as actions. It is the Resource Allocation Directive that represents the product (outcome) of the decision-making process.

2.5 DIFFERENCES FROM THE PREVIOUS FRAMEWORK DOCUMENT

The previous Command Process Model presented a decision cycle in a single loop from the input to the output. The enhanced version puts emphasis on the three cycles of decision making as described in section 3.1. Because the behavior of the model, with respect to these three cycles, depends on the procedures prescribed by the plan, the order of the functions has been changed to

start with Plan, then to follow the middle cycle of Observe-Assess-Execute. The names used for the four principal functions have been shortened to one word for convenience. They correspond, roughly, to the longer phrases of the previous version, as follows:

Observe	Assemble Information
Assess	Assess Situation
Plan	Generate/Select Course-of Action
Execute	Direct Actions

There is a slight difference, however, in the decomposition/allocation of the subfunctions of the third and fourth functions in the above list in order to account for the contingency branching process in the middle cycle. Table 1, Correspondence Between Functions, shows where the split was implemented. Note where the old 2.2 and 3.4 were divided.

TABLE 1. CORRESPONDENCE BETWEEN FUNCTIONS

<u>Current Function Number and Name</u>	<u>Previous Number</u>
2.0 OBSERVE	
2.1 CHARACTERIZE DATA	1.2
2.2 MAINTAIN DATA	1.1
2.3 GENERATE TACTICAL PICTURE	1.3
3.0 ASSESS	
3.1 CHARACTERIZE CURRENT SITUATION	2.1
3.2 ASSESS PLAN PROGRESS	Part of 2.2
3.3 ASSESS PLAN EFFECTIVENESS	Part of 2.2
3.4 CONDUCT MISSION ASSESSMENT	2.3
1.0 PLAN	
1.1 DEFINE AND BOUND ASSIGNED MISSION	3.1
1.2 DEVELOP ALTERNATIVE COURSES OF ACTION (COA)	3.2
1.3 SELECT PROSPECTIVE COURSES OF ACTION	3.3 & Part of 3.4
1.4 GENERATE PLANS AND UPDATES	Part of 3.4
4.0 EXECUTE	
4.1 IDENTIFY CURRENT COURSE OF ACTION	Part of 3.4
4.2 SCHEDULE RESOURCES	3.5
4.3 GENERATE COMMANDS	4.1

Figure 2, Command Process Model Vs. Previous Version, shows the Command Functions to the second tier of decomposition, as in figure 1. In addition, a frame has been inserted to surround those functions that were contained in the function, "Develop/Evaluate Alternatives and Select Course of Action," in the previous version. This frame corresponds to previous numbers 3.1 to 3.5 in Table 1.

The additional functions of Sense (S.0) and Act (A.0) were added explicitly in this version to account for coupling to the physical world, whereas Receive and Issue are connections to the information world. The letter designations were chosen so that no sequence would be implied relative to the four principal functions.

In addition to these changes, there were minor changes in function 2.2.3, to highlight assimilation of own resource data, and the subfunction 1.2.5 was added to recognize the dependence on external support. Function 1.2.4 is a combination of the previous 3.2.4 and 3.2.5, since activity and procedures are closely related.

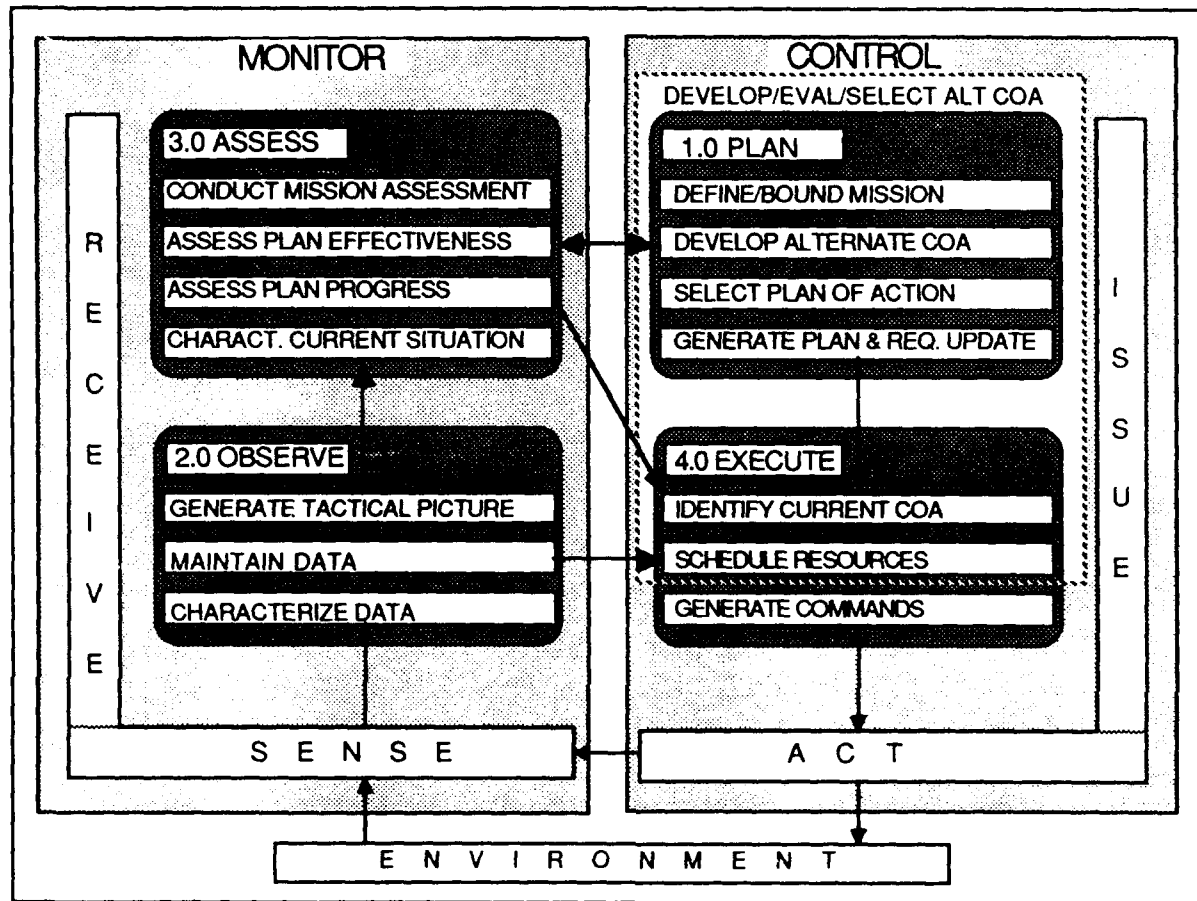


Figure 2. Command Process Model Vs. Previous Version

2.6 RELATION TO OTHER DECISION PROCESS MODELS

The Command Functions listed in the appendix were derived as an amalgamation of several models of decision making. These include the Stimulus-Hypothesis-Option-Response (SHOR) model attributed to the late J. Wohl (reference (b)), the Lawson model (reference (c)) of Sense, Process, Compare, Decide and Act and the Headquarters Effectiveness Assessment Tool (HEAT) model (reference (d)) of Monitor, Understand, Plan, Decide, and Direct. Reference (e), an Army source, uses Acquire-Assess-Determine-Direct. Reference (f), providing an Air Force perspective, cites the Observe-Orient-Decide-Act loop of Colonel John Boyd. Each of these emphasizes a different aspect of the process which the Command Process Model represents. Each has an implicit or explicit Input-Output, Sense-Act or Stimulus-Response functionality to couple the model to the rest of the world. The inputs are data of one form or another, including directives. The outputs can only be data or directives, also, so they can only cause action or possibly other decisions, but they are not the physical action.

SECTION 3.0 IMPLICATIONS OF COMMAND PROCESS MODEL

The Command Process Model is intended to provide an organized set of functions that can be used as a structure to define internal and external outcomes of the decision process. It is also intended to provide insight into important considerations for understanding of the decision process. This, too, will aid in the definition of outcomes.

3.1 THREE PRINCIPAL CONTROL LOOPS

The principal feature to note about the Command Process Model structure is the set of three paths through the decision process. These represent three fundamentally different kinds of decision/control cycles. The outside or largest loop consists of passing through all four functions, while the next loop bypasses the Plan function and the inner loop consists of only parts of the Observe and Execute functions. These loops can be called planning control, mode control, and base control, respectively. The planning loop involves the generation and consideration of multiple courses of action within the Plan function and the selection of a subset of these as a set of contingency plans that can be considered for implementation in the Execution function. Each contingency or branch of a contingency can be considered as a mode of operations that can be activated depending on the situation. The changing of modes is dependent on the assessment of the situation in the Assess function. This dependency is represented by the path from the Assess function to the Execute function in the mode control loop. This loop is the most important difference from the previous Framework document functions. For a given mode of operation, the base control loop generates directives that are appropriate for that mode, using information from the Observe function. This loop contains the predominance of activity and remains in effect as long as there is no change in mode required.

The separation of the planning control and mode control loops is an important concept in effective decision making. Both Plan and Execute have a role in selecting courses of action. The planning loop involves generation, consideration, and selection of options, but the final decision is deferred until execution. Execute makes that decision, as well as the sequential decisions needed to carry out the selected option. The planning loop is a deliberative one and takes time. Most decisions are made without going through such a process, but rather by choosing among courses of action that are predetermined by prior planning or that are familiar or preferred, due to previous experience (and success). At the same time, the planning loop provides for dealing with the unanticipated situation. The differentiation of the three loops is an enhancement of the Command Process Model used in the Framework document.

3.2 TWO KINDS OF DECISION MAKING

There are two kinds of decisions that are made within the decision process: intentional and inferential. The main purpose of decision making is to initiate a function that is intended to cause a change of state or an emission, which, in turn, is intended to have further effects, internally or externally. This is an "intentional" decision. But, in reaching those decisions, it is often necessary to infer, from available information, the nature of the stimuli or states of the system and its surroundings, including other systems. These are "inferential" decisions. In general, the difference is that the former is a "decision to do something," and the latter is a "decision that something is true or false" or a "decision to believe something." Intentional decisions involve resource allocation and direction; while inferential decisions concern data interpretation and situation assessment. Inferential decisions are made in Observe and Assess, while intentional decisions are made in Plan and Execute. These two kinds of decisions are synonymous with hypothesis selection and option selection. These represent the two sides of the model: the inferential side which monitors and the intentional side which controls.

These two kinds of decision making occur in each of the three types of control loop. In the base control loop, inferences are made in Observe relative to the tactical picture or force readiness, while Execute makes intentional decisions regarding resource-task allocations and direction. In the mode control loop, Assess makes inferential decisions about the situation to which Execute responds with an intent to change operations. In the planning loop, these two kinds of decisions are performed at a higher level. The Assess function infers that current trends are not converging and Plan generates a new course of action intended to correct the problem.

3.3 INFORMATION FLOW AND CONTROL FLOW

The two kinds of decisions correspond, roughly, with two kinds of data flow: Information Flow and Control Flow. Information is essentially what can be inferred from data. Control is a form of data that results from intentional decisions. Since inferences are made in Observe and Assess, two kinds of information can be identified as simply observations and assessments. On the control side, there are plans and directives. The differences are subtle and only important in a relative way. Organizational relationships determine how information and control are used in a system.

3.4 AUTHORITY AND RESPONSIBILITY

It is well known that authority can be delegated, but that responsibility can not. A Commander is responsible for the actions of subordinates, so he can delegate the authority to make the decisions to perform them. While the lack of authority does not prevent action, it inhibits it in a well-disciplined organization, while having authority enables decision-making action. It is important to have the right amount of authority delegated to the right level at the appropriate time. With respect to the Command Functions, responsibility and authority are characteristics of control, involving Plan and Execute. In particular, authority is a condition for making intentional decisions, though not always required.

3.5 COORDINATION

Coordination among organizational elements is not a separate function, but involves performing the decision process functions as a joint effort. In effect, coordination is a multielement planning, decision or synchronization activity. It is accomplished by performing the decision process individually, sharing results, identifying conflicts or mutual support requirements, and revising plans to make them consistent. Synchronization is done by using times, events, or signals to initiate action. Each of these steps is individually contained in the Command Functions.

3.6 COST OF CHANGE

An important factor must be taken into consideration when making a change in control mode or changing plans; that is the cost of change (reference (g)), which is the time to implement the change and the possibility that the time or the change itself will cause additional losses due to delay or confusion. This factor must be considered in the assessment of the situation and the replanning or mode control cycles. Another important point is that this factor is mitigated by good contingency planning and highlights the value of such planning. Having prepared for contingencies reduces the time needed to implement them and reduces the chance of confusion, if they are simply stated and familiar to the organizational elements.

SECTION 4.0 SUMMARY OF COMMAND FUNCTIONS

The Command Functions, as defined in the enhanced Command Process Model, emphasize the following crucial ideas:

1. Planning is an essential function even during the Execution phase, where it is often called Replanning.
2. There are two sides to the decision process, interpretation and direction, inferential and intentional, monitor and control, etc.
3. These two sides can have many layers, but for simplicity, three conceptual layers of decision activity are descriptive of three classes of decision cycles: base control, mode control, and planning control.
4. The purpose of the decision process is the allocation of resources to perform certain functions in order to achieve an intended outcome.

SECTION 5.0 REFERENCES

- a. Command, Control, Communications and Intelligence Operational Requirements Framework: Command Process Model, Naval Ocean Systems Center Technical Document (TD 1309), July 1988
- b. Wohl, Joseph G., "Force Management Decision Requirements for Air Force Tactical Command and Control" *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-11 September 1981, pp. 618-639
- c. Lawson, Dr. Joel S., Jr., "The Art and Science of Military Decision Making", *Phalanx*, vol. 15, no. 4, December 1982
- d. Headquarters Effectiveness Assessment Tool (HEAT) Description and Briefing Materials, Defense Systems, Inc., No date
- e. Dacunto, Col. L. J., "U.S. Army C2 System Master Plan and Status", in *Proceedings of 5th Annual Workshop on C2 Decision Aiding*, Army Research Institute Field Unit, Fort Leavenworth, September 1988
- f. Orr, Maj. G. E., *Combat Operations C3I: Fundamentals and Interactions*, Air University Press, July 1983
- g. Snyder, Dr. Frank, Naval War College, Personal Communication, November 1988

ORGANIZATION OF THE APPENDIX

The principal Command Functions are Plan, Observe, Assess, and Execute. Each of these is described in its own section, numbered in that order. Within each of these sections, there are two subsections (the first and last in each section) called Receive and Issue; these are labeled with the section number and an "R" or "I", respectively. These subsections represent the data that has to be transferred between and among the Command Functions and/or the external world. Collectively, they represent all the data transferred, but they are listed with the Command Function that uses or produces them.

The additional functions of Sense (S.0) and Act (A.0) are added to account for coupling to the physical world, whereas Receive and Issue are connections to the information world. The letter designations were chosen so that no sequence would be implied relative to the four principal functions.

Preceding the functional descriptions is a list, Table A-1, of all the functions to the third tier of decomposition. This list provides a compact view of the structure of each function, as well as serving as a table of contents.

TABLE A-1. LIST OF COMMAND FUNCTIONS

<u>Function Number</u>	<u>Function Name</u>	<u>Page</u>
1.0	PLAN.....	A-7
1.R	RECEIVE DATA	A-7
1.R.1	External.....	A-7
1.R.2	From ASSESS (3.0).....	A-7
1.1	DEFINE AND BOUND ASSIGNED MISSION	A-7
1.1.1	Interpret Mission/Directives from Higher Authority.....	A-8
1.1.2	Develop Mission Statement.....	A-8
1.1.3	Describe Area of Operations.....	A-8
1.1.4	Describe Own and Related Force	A-8
1.1.5	Describe Enemy Force	A-8
1.1.6	Estimate Relative Strengths and Weaknesses of Opposing Forces	A-8
1.1.7	Postulate Enemy Courses of Action	A-8
1.2	DEVELOP ALTERNATIVE COURSES OF ACTION (COA).....	A-8
1.2.1	Propose Organizational/Command Structure.....	A-8
1.2.2	Propose Mission/Task Objectives for Subordinates	A-8
1.2.3	Propose Resource Composition.....	A-8
1.2.4	Propose Resource Activity (Time, Place, Tactics) and Propose Operating Procedures.....	A-9
1.2.5	Determine Requirements for External Support.....	A-9
1.2.6	Propose Enemy Responses within each COA.....	A-9
1.2.7	Identify Effectiveness Criteria for Each COA	A-9
1.2.8	Relate Effectiveness Criteria to Mission Success Criteria.....	A-9
1.3	SELECT PROSPECTIVE COURSES OF ACTION	A-9
1.3.1	Evaluate Own-Courses of Action with Respect to Suitability, Feasibility, Acceptability	A-9
1.3.2	Evaluate Effectiveness of Own-Courses of Action Against Enemy COA.....	A-9
1.3.3	Prioritize Alternative Courses of Action.....	A-9
1.3.4	Identify Risks and Shortfalls.....	A-9
1.3.5	Select Primary and Contingency Courses of Action.....	A-9
1.4	GENERATE PLANS AND UPDATES.....	A-9
1.4.1	Develop Concept of Operations.....	A-10
1.4.2	Elaborate the Objectives, Organization, Resources and Procedures for Each Contingency.....	A-10
1.4.3	Specify/Modify Contingency Situations and Responses.....	A-10
1.4.4	Delegate Authority in Accordance with Plan.....	A-10
1.4.5	Document Plan and Supporting Annexes	A-10

TABLE A-1. LIST OF COMMAND FUNCTIONS (Continued)

<u>Function Number</u>	<u>Function Name</u>	<u>Page</u>
1.I	ISSUE OPTIONS, PLANS, UPDATES	A-10
1.I.1	External Promulgation of Plan.....	A-10
1.I.2	External Request for Authority	A-10
1.I.3	To EXECUTE (4.0)	A-10
1.I.4	To ASSESS (3.0)	A-10
1.I.5	To OBSERVE (2.0).....	A-10
2.0	OBSERVE	A-11
2.R	RECEIVE DATA	A-11
2.R.1	External Receive Communications Data.....	A-11
2.R.2	External Sensor/Event Data	A-11
2.R.3	From EXECUTE (4.0)	A-11
2.R.4	From PLAN (1.0).....	A-11
2.R.5	From ASSESS (3.0).....	A-11
2.R.6	From SENSE (S.0).....	A-12
2.R.7	From ACT (A.0)	A-12
2.1	CHARACTERIZE DATA.....	A-12
2.1.1	Sort and Associate Events	A-12
2.1.2	Discriminate and Identify Events.....	A-12
2.1.3	Compile Resource Status/Condition Data.....	A-12
2.2	MAINTAIN DATA	A-12
2.2.1	Update.....	A-12
2.2.2	Archive.....	A-12
2.2.3	Test.....	A-12
2.3	GENERATE TACTICAL PICTURE.....	A-13
2.3.1	Develop Current and Projected Contact Picture	A-13
2.3.2	Develop Current and Projected Geophysical/Environmental Picture	A-13
2.3.3	Develop Current and Projected Significant Tactical Information.....	A-13
2.I	ISSUE REPORTS AND DATA	A-13
2.I.1	External.....	A-13
2.I.2	To EXECUTE (4.0)	A-13
2.I.3	To ASSESS (3.0).....	A-13

TABLE A-1. LIST OF COMMAND FUNCTIONS (Continued)

<u>Function Number</u>	<u>Function Name</u>	<u>Page</u>
3.0	ASSESS.....	A-14
3.R	RECEIVE DATA	A-14
3.R.1	External.....	A-14
3.R.2	From PLAN (1.0).....	A-14
3.R.3	From OBSERVE (2.0)	A-14
3.R.4	FROM EXECUTE (4.0)	A-14
3.1	CHARACTERIZE CURRENT SITUATION	A-15
3.1.1	Characterize Enemy Posture.....	A-15
3.1.2	Characterize Own-Force Posture.....	A-15
3.1.3	Characterize Neutral Activity	A-15
3.1.4	Characterize Environmental Effects.....	A-15
3.1.5	Highlight Significant Tactical Information.....	A-15
3.2	ASSESS PLAN PROGRESS	A-15
3.2.1	Compare Current or Projected Tactical Situation to Plan.....	A-15
3.2.2	Determine if Contingency Criteria Met	A-15
3.3	ASSESS PLAN EFFECTIVENESS.....	A-15
3.3.1	Identify Uncertainties or Deviations from Plan.....	A-16
3.3.2	Determine Adequacy of Resources and Data	A-16
3.3.3	Predict Outcome and Likelihood	A-16
3.3.4	Compare to Desired Outcome	A-16
3.3.5	Identify Replanning or Update Requirements	A-16
3.3.6	Evaluate Relative Merits or Options	A-16
3.4	CONDUCT MISSION ASSESSMENT.....	A-16
3.4.1	Conduct On-Going/Intermediate Assessments	A-16
3.4.2	Conduct Post Operations Reconstruction/Final Assessment.....	A-16
3.1	ISSUE REPORTS AND ASSESSMENTS	A-16
3.1.1	To External for Status of Operations and Mission Assessment.....	A-16
3.1.2	To PLAN (1.0)	A-16
3.1.3	To OBSERVE (2.0).....	A-17
3.1.4	To EXECUTE (4.0)	A-17

TABLE A-1. LIST OF COMMAND FUNCTIONS (Continued)

<u>Function Number</u>	<u>Function Name</u>	<u>Page</u>
4.0 EXECUTE		A-18
4.R RECEIVE PLANS, DATA AND STATUS		A-18
4.R.1 From PLAN (1.0).....		A-18
4.R.2 From OBSERVE (2.0)		A-18
4.R.3 From ASSESS (3.0).....		A-18
4.1 IDENTIFY CURRENT COURSE OF ACTION.....		A-18
4.1.1 Select Appropriate Contingency COA Based on Plan		A-19
4.1.2 Identify Tasks/Requirements		A-19
4.1.3 Initiate Adjustments.....		A-19
4.2 SCHEDULE RESOURCES		A-19
4.2.1 Determine Resource Availability/Capability		A-19
4.2.2 Assign Resources to Tasks		A-19
4.3 GENERATE COMMANDS		A-19
4.3.1 Direct Change in Status, Posture, System Modes		A-19
4.3.2 Transform Data for Control.....		A-19
4.3.3 Document Command Directives.....		A-19
4.I ISSUE COMMAND DIRECTIVES, REPORTS/REQUESTS		A-19
4.I.1 To ASSESS (3.0).....		A-19
4.I.2 To OBSERVE (2.0).....		A-19
4.I.3 To External.....		A-19
4.I.4 To SENSE (S.0).....		A-19

TABLE A-1. LIST OF COMMAND FUNCTIONS (Continued)

<u>Function Number</u>	<u>Function Name</u>	<u>Page</u>
S.0	SENSE	A-20
	S.R. RECEIVE/SENSE OWN AND REMOTE SENSOR DATA.....	A-20
	S.R.1 From Environment.....	A-20
	S.R.2 From Own and Other Resources	A-20
	S.R.3 From EXECUTE (4.0).....	A-20
	S.R.4 From ACT (A.0).....	A-20
S.1	GENERATE SENSORY/EVENT DATA.....	A-20
	S.1.1 Sense Own Resource Sensory Data	A-20
	S.1.2 Process Own or Other Sensed Data	A-20
	S.1.3 Estimate Background.....	A-20
	S.1.4 Set Thresholds.....	A-20
	S.1.5 Generate/Format Threshold Crossing Events	A-21
S.I	ISSUE DATA REPORTS	A-21
	S.I.1 To OBSERVE (2.0)	A-21
A.0	ACT	A-22
	A.R RECEIVE COMMANDS.....	A-22
	A.R.1 From EXECUTE (4.0).....	A-22
	A.1 IMPLEMENT COMMANDS	A-22
	A.1.1 Set Equipments.....	A-22
	A.1.2 Actuate Weapons and Countermeasures.....	A-22
	A.1.3 Operate Sensors	A-22
	A.1.4 Control Platforms	A-22
	A.1.5 Energize Simulators/Stimulators.....	A-22
	A.2 GENERATE ACTION FEEDBACK.....	A-22
	A.3 SYNCHRONIZE ACTION	A-22
	A.I ISSUE ACTIONS AND FEEDBACK DATA.....	A-23
	A.I.1 To OBSERVE (2.0).....	A-23
	A.I.2 To SENSE (S.0).....	A-23
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1.0 PLAN

"Planning" is the establishment of control procedures for the accomplishment of a purpose. It generates the pattern for the desired behavior of the forces or elements to be controlled in response to future events caused by one's own or others' actions. Several alternatives may be developed but only one chosen as the Plan of Action, although it may have contingency branches which anticipate uncertainty in multiple future events.

At a given organizational level, this function provides for the reception of direction from a higher organizational level, bounds the problem (1.1), generates alternative courses of action (1.2), provides for the selection of a plan consisting of a primary and contingency courses of action (1.3), and then generates the initial plan, and any required updates to it (1.4), for implementation by other functions. Any of the subfunctions of PLAN may uncover ambiguities or conflicts in direction or shortfalls in resources. These are referred to higher authority for resolution.

The objective of this function is to establish a plan or framework of contingencies with control procedures and a set of rules to resolve conflicts caused by limitations and uncertainties. It is through the ASSESS (3.0) function that evaluations/assessments of alternative plans are performed, based on the proposed use of available resources. The PLAN (1.0) function selects particular options and establishes control procedure which are used to resolve conflicts. The selection of the preferred option and control procedures is intended to provide a structure for the desired behavior of the resources available to a given organizational unit. Limitations in the resources and uncertainties in the exact knowledge of the problem to be solved require the capability to handle various types of iterations, prioritizations and plan updates such that the overall goals are met when it may not be possible to follow an exact preconceived solution/plan. The main product of the PLAN (1.0) function is a plan of action, which is a clear and unambiguous set of tasks and procedures that the EXECUTE (4.0) function receives for implementation as guided by information from OBSERVE (2.0) and assessments from ASSESS (3.0). Plans are disseminated externally and, in particular, to subordinates, for guidance, and to other organizations for coordination.

1.R RECEIVE DATA

1.R.1 External

Directives from higher organization level and coordinating information from other resources that define objectives, bounds, limits, doctrine and assumptions.

1.R.2 From ASSESS (3.0)

Current tactical situation and assessment/ evaluations of contingencies, associated risks, and resource readiness/availability for plan selection/generation.

1.1 DEFINE AND BOUND ASSIGNED MISSION

This function is the first step in the planning process. It is this process that bounds the problem to be solved and limits the options for consideration. It interprets the directive from higher authority within the framework of the general background of the operation, the superior's mission and the capabilities and limitations of assigned resources. It establishes specific goals and objectives and characterizes the generally expected unfolding of the situation. It is constrained by established

procedures and rules of engagement set by higher authority. Enemy force characteristics are described and his response to own force our mission is postulated.

1.1.1 Interpret Mission/Directives from Higher Authority

1.1.2 Develop Mission Statement

1.1.3 Describe Area of Operations

1.1.4 Describe Own and Related Force*

1.1.5 Describe Enemy Force

1.1.6 Estimate Relative Strengths and Weaknesses of Opposing Forces

1.1.7 Postulate Enemy Courses of Action

1.2 DEVELOP ALTERNATIVE COURSES OF ACTION (COA)

"Develop Alternative Courses of Action" uses the characterization of the current situation (Cf. NWP-11, Estimate of the Situation) developed in 3.1 along with the Mission Definition derived in 1.1 to conceive proposed courses of action and alternatives (Options). In this process, additional information or guidance may be requested from the higher command authority, when proposed options appear to go beyond the bounds set above.

This process involves the delineation of procedures and nominal identification of organic and non-organic resource requirements for each proposed option. Within each option, a more specific characterization of the expected situation is derived in terms of the proposed activity, operating procedures and enemy responses anticipated for that approach. Within each option, several contingencies may be executable in 4.0, while carrying out the plan. These contingencies of the plan are an integral part of each option, along with the conditions which, when met, would indicate which contingency to execute.

For each option, an evaluation of the potential outcome, based upon an identified effectiveness criteria, risks and benefits will be required. This kind of assessment is performed in the ASSESS (3.0) process.

In the event of the necessity to perform a replanning process, new alternatives may need to be generated or earlier options updated with more recent information or direction.

1.2.1 Propose Organizational/Command Structure

1.2.2 Propose Mission/Task Objectives for Subordinates

1.2.3 Propose Resource Composition

Based upon the required supporting tasks and the availability of resources, propose the composition of resources.

* Allied, Joint, other U.S. Navy

1.2.4 Propose Resource Activity (Time, Place, Tactics) and Propose Operating Procedures

Propose standard operating procedures, tactics and rules of engagement for each course of action.

1.2.5 Determine Requirements for External Support

1.2.6 Propose Enemy Responses within each COA

1.2.7 Identify Effectiveness Criteria for Each COA

1.2.8 Relate Effectiveness Criteria to Mission Success Criteria

1.3 SELECT PROSPECTIVE COURSES OF ACTION

This is the classical decision function. "Select Plan of Action" provides a quantitative or qualitative prioritization or preference among the alternatives. This process involves a review of the assessment and potential outcome of each alternative and its advantages/disadvantages, suitability, feasibility, and acceptability; and the estimation of the probability of success and the risks associated with each alternative. The assessment relies on the capabilities available in 3.3. In this function, additional information or resources can be requested from a higher organizational level if the proposed plan has an unacceptable risk. This function provides for the selection of a set of tasks to be implemented and its corresponding set of control procedures. The set of tasks and the control procedures constitute the elements of the plan, which embodies the strategy/approach and associated contingencies or branches.

This function also must accommodate the replanning/update process when it is determined in ASSESS (3.0) that the latest plan can no longer be met (see 3.3). This may require cessation of tasks being executed. As a result of replanning, the new set of control procedures and tasks becomes the latest plan and replaces the previous one. Minor adjustments in the plan might be accommodated in the plan generation process (1.4).

1.3.1 Evaluate Own-Courses of Action with Respect to Suitability, Feasibility, Acceptability

1.3.2 Evaluate Effectiveness of Own-Courses of Action Against Enemy COA

1.3.3 Prioritize Alternative Courses of Action

1.3.4 Identify Risks and Shortfalls

1.3.5 Select Primary and Contingency Courses of Action

1.4 GENERATE PLANS AND UPDATES

The generation of the original plan and associated updates involves the elaboration of the detail required to clearly and concisely communicate the expected objectives, schedule of events and methods of achieving them to other elements of the organization including subordinates, support elements and superiors. This plan/update includes such items as the intended movement, support, protection, coordination, and methods of control of the assigned resources.

The plan must also identify a set of conditions that describe the expected situation, and the criteria for identifying those situations, which will call for a change in the course of action in effect at that time. These criteria are used by ASSESS (3.0) to identify plan progress and for the interpretation

of the meaning and intent of the future situation. The conditions must be distinct and separable (mutually exclusive) in order to avoid confusion in the execution of the plan. The actions must also be mutually exclusive in a way that will not cause resource conflict. If the conditions or actions are ambiguous, replanning will be required.

The formulation of the plan may involve the dissemination of a preliminary operational plan/directive to subordinates. After coordinating with subordinates and evaluation the asset readiness posture, the final plan is generated for dissemination to higher authority, coordination elements and to subordinates.

1.4.1 Develop Concept of Operations

1.4.2 Elaborate the Objectives, Organization, Resources and Procedures for Each Contingency.

1.4.3 Specify/Modify Contingency Situations and Responses.

1.4.4 Delegate Authority in Accordance with Plan

1.4.5 Document Plan and Supporting Annexes

1.1 ISSUE OPTIONS, PLANS, UPDATES

1.1.1 External Promulgation of Plan

Plans and reports to subordinate organizations for guidance and to others for coordination. Reports of inadequate guidance and resource shortfalls to higher level authority.

1.1.2 External Request for Authority

Request for authority to cover a situation if not authorized in plan.

1.1.3 To EXECUTE (4.0)

Plan of Action and Updates for implementation by own organization.

1.1.4 To ASSESS (3.0)

Plans for assessment of bounds, evaluation of options and criteria for plan progress assessment.

1.1.5 To OBSERVE (2.0)

Plans for archival purposes and criteria for recognition of the present situation.

2.0 OBSERVE

This function provides for the collective perception of the current and projected tactical picture as a result of the combination of all available information. It supports the assessment in 3.0 of the current situation such as threat posture, hostile activities and encounters. It depicts own force posture and maintains own force operational data. The function associates and correlates the pre-processed sensor reports from own and other resources into a multi-source event description that includes event position, time, confidence, and other properties. It discriminates objects and events according to types and tracks objects. The function also addresses the state of own force and the environment by combining relevant data about them.

At a given organizational level, this function provides for the reception of information from within the organization for the purposes of characterizing the incoming data (2.2) including the current direction from EXECUTE (3.0), maintaining/updating a master set of information (2.1) and generating the current and projected tactical picture (2.3) to be provided to the ASSESS (3.0) and EXECUTE (3.0) functions. This evaluation process generates the best level of knowledge concerning all observed contacts (hostile, friendly, neutral or unknown and the background)

Several hypotheses about the current tactical picture may be postulated. Evidence in support or denial of these alternative pictures is sought in the event data from information sources. Each hypothetical picture may exist with varying degrees of confidence. The most important hypotheses may be the most likely or the ones of most concern. All important hypotheses must be available to the ASSESS (3.0) function.

From all the estimates and confidence levels, the current tactical picture is generated and is used in the ASSESS (3.0) function. It is through the positional/motion estimates, with associated confidence levels, that the EXECUTE (4.0) function obtains information to generate the commands required.

2.R RECEIVE DATA

2.R.1 External Receive Communications Data

Raw and preprocessed sensor data and correlated or associated data from own and other sources for information sharing. Resource Status and Material Condition data from own sources.

2.R.2 External Sensor/Event Data

Sensory/event/resource data for combination with other data and archiving.

2.R.3 From EXECUTE (4.0)

Command data defining status of execution and resource allocations for purpose or anticipating events as well as for archiving status of execution.

2.R.4 From PLAN (1.0)

Plans, doctrine, and data concerning higher organizational levels/resources for archival criteria for recognition of the situation.

2.R.5 From ASSESS (3.0)

Control of tactical picture projection and mission assessment for archiving.

2.R.6 From SENSE (S.0)

Sensory/Event Data

2.R.7 From ACT (A.0)

Data for Command Feedback

2.1 CHARACTERIZE DATA

All available data required for the assessment of the situation is assembled in this function. After sorting and associating all source event data (2.1.1) into groups with similar attributes the data is further processed, or correlated, (2.1.2) to identify known objects and aid in the discrimination of objects and events with measures of confidence. Resource Status/Condition data are sorted and compiled (2.1.3) in preparation for assessment.

2.1.1 Sort and Associate Events

This function sorts and associates individual detection events into data groups having similar attributes. Based on these data and known properties of object types, this function produces a report which includes a group of measurements, time of occurrence, and other properties detectable by the sensor along with confidence levels.

2.1.2 Discriminate and Identify Events

This function compares the information reports with known properties of object types to produce a preliminary discrimination between events and objects, and among object types. A full discrimination may be deferred until reports from all available sensors are correlated in function 2.3.1. This preliminary discrimination takes the form of an event/object identification and confidence level.

2.1.3 Compile Resource Status/Condition Data

This function is the collection and analysis of statistics concerning the status/condition of all available resources including own status/condition. This function monitors the configuration and readiness of resources (equipment, weapons, personnel, etc.) and collects information so that required actions can be directed and performed within the limits of capabilities, and so corrective actions can be taken to overcome degradations or to reconfigure resources.

Knowledge of the status of resources to conduct the mission is compiled, ambiguities are resolved and a report is generated for use in the assessment of plan progress and effectiveness. Personnel and material status is compiled for own and supporting resources. Material status includes platform, equipment and expendable stores.

2.2 MAINTAIN DATA

This function receives sensory and message data/information and maintains the historical and real-time/near real-time tactical data information bases. Tests are conducted to ensure that the consistency of the data is maintained.

2.2.1 Update

2.2.2 Archive

2.2.3 Test

2.3 GENERATE TACTICAL PICTURE

The current tactical situation is determined by integrating the position and movement of own force and enemy units from all-source sensor information. The tactical picture is composed of the position, velocity, identity, status, and salient characteristics of all objects in the area of interest along with estimates of the quality of those parameters. It also may project the tactical picture into the future based on direct sensing data and the requirements defined by the Assessment of Plan Progress (3.2). The location of tactically significant oceanic (e.g., fronts and eddies), electromagnetic (e.g., ionospheric) and acoustic (e.g., sonic layer depth) features are included, as are the current and forecast weather conditions.

It is this function that takes all the observed contacts, associated relationships, and attributes and generates the best level of knowledge concerning all contacts (hostile, friendly, neutral or unknown). The level of knowledge achievable is dependent on the data fidelity and sensors/processing available. The goal is to resolve positional estimates, motion estimates, (velocity, direction, acceleration) and associated attributes such as actual/estimated type. All estimates are provided with some confidence level. Multiple hypotheses may be carried awaiting sufficient event data to clarify differences. Additionally, the best knowledge of the environmental effects is generated.

In specific cases, this current tactical picture can provide the required data to perform branch selection in EXECUTE (4.0) for certain types of response criteria. Additionally, certain elements of the tactical picture are compared to the desired result in EXECUTE (4.0) for actual command generation for the accomplishment of specific tasks by specific resources.

In addition to the environmental background, the position of objects/events relative to some artificial boundaries (such as search areas, missile envelopes, etc.) may be important. These *artificial boundaries are elements of the tactical overlay picture.*

2.3.1. Develop Current and Projected Contact Picture

Development of the current and projected contact picture involves the quantification of positional/motion estimates and confidence levels, the correlation and the classification based upon associated attribute and confidence levels of all contacts and own forces.

2.3.2 Develop Current and Projected Geophysical/Environmental Picture

2.3.3 Develop Current and Projected Significant Tactical Information

2.1 ISSUE REPORTS AND DATA

2.1.1 External

Data for information sharing by other organizational elements

2.1.2 To EXECUTE (4.0)

Data for the purpose of command generation (4.3.2) and branch selection (4.1.1).

2.1.3 To ASSESS (3.0)

Current and projected tactical picture, readiness status, current COA and COA option to assess the progress and effectiveness of the plan.

3.0 ASSESS

The ASSESS function derives meaning from the information provided by OBSERVE (2.0) in the context of the mission and the plan prescribed by PLAN (1.0). It may also receive assessments from other organizational elements and share its assessments with others. Assessment of mission performance requires a characterization of the current situation (3.1) involving own and enemy posture, neutral activity, projected tactical picture and environmental effects. The assessments of plan progress (3.2) and of plan effectiveness (3.3) support planning, control and execution. Mission assessments (4.4) provide feedback to higher authority once a mission has been completed or aborted or status of the mission while in progress.

Assessment of plan progress (3.2) compares the current situation to the criteria for selecting contingencies or particular action sequences in order to support the branching function in EXECUTE (4.0). Assessment of plan effectiveness (3.3) provides direction and control to the PLAN (1.0) and EXECUTE (4.0) function by indicating whether the current action is meeting the existing plan or a new plan or update is required. Assessments of various options (during planning or significant replanning) are essentially assessments of plan effectiveness done for notional plans instead of the one being executed. The nature of the assessments of plan progress, plan effectiveness or option effectiveness vary in terms of fidelity and/or speed, whether performed in advance or during execution.

An assessment of mission performance provides an assessment of the plans, actions and results of operations conducted to accomplish the mission. In the case of an aborted mission, the analysis examines the progress made in accomplishing the mission and the conditions that caused the mission to be aborted. During the operation, these constitute progress reports to higher authority detailing assessments of force performance, current hostile threat, neutral activity and current force assets status. Conflicts may be resolved by requesting additional information from higher organizational levels or reference to PLAN (1.0).

3.R RECEIVE DATA

3.R.1 External

Assessments from Others.

3.R.2 From PLAN (1.0)

Proposed Goals for Bounding, Proposed Options/Procedures for Alternative Selection and Conflict Resolution; Criteria for Plan Progress Assessment.

3.R.3 From OBSERVE (2.0)

Current Tactical Picture and Resource Status and Current COA.

3.R.4 From EXECUTE (4.0)

Current branch for interpretation of tactical picture.

3.1 CHARACTERIZE CURRENT SITUATION

Based on the objective (non-subjective) information from OBSERVE (2.0), this function attempts to extract the meaning or implication of the current tactical picture in terms of capabilities, advantages and intentions. This characterization is used by other functions of ASSESS. Several hypotheses about the situation may be generated. Evidence in support or denial of these possible meanings is sought in the data from OBSERVE (2.0). Each hypothesis may exist with varying degrees of confidence, risk and payoff.

Certain aspects of the information may have particular importance in carrying out an assessment. These may be highlighted in order to provide for more efficient or responsive assessments.

3.1.1 Characterize Enemy Posture

A characterization of the enemy's posture involves an evaluation of tactics and operational effectiveness, the state of operational capability and readiness, intentions, and the vulnerabilities.

3.1.2 Characterize Own-Force Posture

A characterization of the own force posture involves an evaluation of tactics and operational effectiveness, the state of operational capability and readiness, intentions, and the vulnerabilities.

3.1.3 Characterize Neutral Activity

3.1.4 Characterize Environmental Effects

A characterization of the environmental effects involves an interpretation of the atmospheric, geophysical and oceanographic effects as it relates to the situation.

3.1.5 Highlight Significant Tactical Information

Highlighting of significant information is the additional analysis performed to compare postures, identify outside influences and identify advantages and weaknesses of the situation.

3.2 ASSESS PLAN PROGRESS

This function evaluates progress along the plan in order to support the decision to EXECUTE (4.0) by comparing the known current situation (including hostile intent) with a set of conditions used to determine if the plan is being executed toward the expected sequence of events or intended outcome. These criteria are established by the PLAN (1.0) function. As long as the plan is being met (see 3.3), then this function defines the continuation process including some required branching decisions.

3.2.1 Compare Current or Projected Tactical Situation to Plan

3.2.2 Determine if Contingency Criteria Met

3.3 ASSESS PLAN EFFECTIVENESS

In support of the PLAN (1.0) function, the effectiveness assessment is used to assess bounds, develop options, and provide conflict resolution and identify risks in the current plan. The assessment may result in the realization that the current plan (including its contingencies) is not adequate to accomplish the mission and that a new plan or strategy is required. If a new update is required then the execution process may be inhibited and a new replan is initiated.

This function provides the anticipation necessary to avoid blindly following a plan that is no longer likely to succeed, due to changes in the intermediate outcomes or previously unknown information or altered assumptions. This function projects the current situation based on expected results of one's actions and inferences derived from knowledge about enemy and own force posture, capabilities, and intent. This projection results in an anticipated outcome and is couched in terms of its likelihood of occurrence and associated risks and payoffs.

When ASSESS needs to conjecture future situations, it will advise OBSERVE what assumptions to make in order to predict the future tactical picture, if they are different from what are substantiated by the state vectors derived from the data.

As an assessment of the latest (current) plan, deleterious outcomes indicate the need to replan. As an assessment of options during the planning (or replanning) process, this evaluation can serve as the means, in PLAN (1.0), to rank or prioritize the options under consideration.

3.3.1 Identify Uncertainties or Deviations from Plan

3.3.2 Determine Adequacy of Resources and Data

3.3.3 Predict Outcome and Likelihood

3.3.4 Compare to Desired Outcome

3.3.5 Identify Replanning or Update Requirements

3.3.6 Evaluate Relative Merits or Options

3.4 CONDUCT MISSION ASSESSMENT

When the mission or an intermediate objective has been accomplished, suspended, or aborted, mission assessment is performed. This involves an assessment of goals and objectives that were met, reconstruction of events and lessons learned that may be of value in future missions or engagements. During the operation, this constitutes a progress report to higher authority.

3.4.1 Conduct On-Going/Intermediate Assessments

3.4.2 Conduct Post Operations Reconstruction/Final Assessment

3.1 ISSUE REPORTS AND ASSESSMENTS

3.1.1 To External for Status of Operations and Mission Assessment

Reports and assessment data to other organizational levels for the purpose of sharing assessment information or gaining additional information for conflict resolutions.

3.1.2 To PLAN (1.0)

Assessment/evaluation of plans for the purpose of bounding, developing options/control procedures, providing conflict resolution and supporting updates.

3.I.3 To OBSERVE (2.0)

Assessment of plans for archiving.

3.I.4 To EXECUTE (4.0)

Assessment of plans for the purpose of continuing execution, selecting the next branch, or inhibiting executions during an update process.

4.0 EXECUTE

The EXECUTE function provides the processes that define and describe the specific actions to be effected in order to "carry out" the prescribed plan of action. It translates the plan into directives based on the latest information available from OBSERVE (2.0) and the inferred situation from ASSESS (3.0).

At a given organizational level, this function provides for the reception of plans and procedures concerning the tasks to be performed from PLAN (1.0), the identification of current activity (3.1), the scheduling of resources (3.2), and the generation of specific command directives (3.3). It is in this function that specific tasks are assigned to specific resources based on resource availability, task requirements and control procedures. This allocation process remains in place until the evolution is completed or until a condition exists for which the ASSESS (4.0) function indicates that a change is required or that the PLAN (1.0) is not going to be met. For the period of time that the PLAN (1.0) is being met, the generation of command directives in the performance of a given task uses information derived from the latest current tactical picture from OBSERVE (2.0), associated branching instructions from ASSESS (3.0), the corresponding task requirements, and the specific resource's capability. When the ASSESS (3.0) function recognizes the action is not meeting the plan, then either a new plan or an update will be issued by the PLAN (1.0) function. During the hiatus, task execution may be inhibited or additional ground lost due to inappropriate action. Recovery from this situation is critical. The EXECUTE (3.0) function provides the command directives for implementation by subordinate organizations and associated resources and, to other organizations, for information.

4.R RECEIVE PLANS, DATA AND STATUS

4.R.1 From PLAN (1.0)

Plan of Action for scheduling specific resources/tasks.

4.R.2 From OBSERVE (2.0)

Status for indications of plans being met/branching instructions (continue/branch/update).

4.R.3 From ASSESS (3.0)

Status data (current tactical picture) for command generation and branch selection.

4.1 IDENTIFY CURRENT COURSE OF ACTION

This function is the predetermined branching function. Based on the assessment of the current situation, this function selects from the predefined set of contingencies (or allowable actions), that which is deemed most appropriate or preferred. Any contingency that is not predefined or any situation not satisfied by a contingency requires a new plan or update to an existing plan. This latter condition is one outcome determined by the ASSESS (3.0) function. The selection of the current main branch is achieved via the ASSESS (3.0) function. The OBSERVE (2.0) function provides for branching within the context of the current main branch. The sub-branch selected needs to be known by ASSESS (3.0) to interpret the current tactical picture. This process involves the determination of the specific tactical and support requirements based on the action requirement of this contingency or branch. It also establishes rules for scheduling resources, identifies data requirements for control generation, and provides criteria for threshold settings.

4.1.1 Select Appropriate Contingency COA Based on Plan

4.1.2 Identify Tasks/Requirements

4.1.3 Initiate Adjustments

4.2 SCHEDULE RESOURCES

This function involves the process of mapping the tasks to available resources. The tasks to be mapped are related to the specific branch of the latest plan. The mapping process involves matching the task requirements to the capabilities of the available resources. It is then that specific commands are generated (4.3) for the implementation of the tasks at hand.

4.2.1 Determine Resource Availability/Capability

4.2.2 Assign Resources to Tasks

4.3 GENERATE COMMANDS

This function involves the direction of assigned assets (force units, surveillance assets, weapons, force countermeasures and non-warfare or support elements). It is the real time equivalent of plan generation but only involves specifying details for the currently active evolution. This function translates the data from OBSERVE (2.0) and the course of action selected by 4.1 into specific direction and tasking orders to be carried out by controlled resources. Equipment settings, sensor operation and platform positioning are specified to optimize performance under the existing environmental conditions and tactical situation.

These orders may be disseminated or used locally. The current direction is used by OBSERVE (2.0) to anticipate events that should be expected as a result of actions being directed.

4.3.1 Direct Change in Status, Posture, System Modes

4.3.2 Transform Data for Control

4.3.3 Document Command Directives

4.I ISSUE COMMAND DIRECTIVES, REPORTS/REQUESTS

4.I.1 To ASSESS (3.0)

Current branch for interpretation of tactical picture.

4.I.2 To OBSERVE (2.0)

Command Directives for archival and current direction purposes.

4.I.3 To External

Disseminate command directives/reports/requests to subordinate organizations and to others for information.

4.I.4 To SENSE (S.0)

Threshold Settings Criteria

S.0 SENSE

At given organizational level, this function provides for the reception of information from lower organizational levels, other resources, and the environment via various sensors, including communications links, and then transforms physical phenomena (S.1) into information representing sensory data and event data, and resource data (S.2) into information representing resource status parameters and conditions. (Messages from external sources listed with other command functions as inputs "X" may be handled through this function.) It is this function that provides data in various forms to the OBSERVE (2.0) function for characterization and the generation of the current tactical picture. The transformation of physical phenomena (S.1) into meaningful events occurs with the sampling of the environment with various methods of transduction and then under temporal synchronization from ACT (A.0), the data is processed. Significant departures from the environmental background represent detections when observe contacts are present. The generation of resource data represents the latest statistics concerning the resources available.

S.R. RECEIVE/SENSE OWN AND REMOTE SENSOR DATA

S.R.1 From Environment

Sensory Data: Acoustic, Electromagnetic, Navigation, Time, etc.

S.R.2 From Own and Other Resources

Resource Data and Sensed Data

S.R.3 From EXECUTE (4.0)

Threshold Settings Criteria

S.R.4 From ACT (A.0)

For Spatial/Temporal Synchronization of Sensors/Processing

S.1 GENERATE SENSORY/EVENT DATA

It is this function that provides sensory/event data from all available resources to the OBSERVE (2.0) function for characterization and the generation of a current tactical picture. This is achieved by sensing/formatting other resource data or by transduction, sampling and processing of own sensors or sensor units. This includes sensing Navigational and time data.

S.1.1 Sense Own Resource Sensory Data

S.1.2 Process Own or Other Sensed Data

S.1.3 Estimate Background

S.1.4 Set Thresholds

S.1.5 Generate/Format Threshold Crossing Events

S.I ISSUE DATA REPORTS

S.I.1 To OBSERVE (2.0)

Provide Sensory/Event Data

A.0 ACT

This function is where command directives from the EXECUTE (4.0) function are implemented to initiate action for the countermeasures. The settings for the control parameters are established in the EXECUTE (4.0) function.

At a given organizational level, this function provides for the reception of information in the form of specific commands from EXECUTE (4.0) for implementation (A.1). It is in this function that specific tasks are executed in a series of specific actions. It is this sequence of events that causes the actual effects on other organizations, resources and the environment.

This function also provides the means of spatial and temporal synchronization (A.3) to the SENSE (S.0) function and action feedback (A.2) to the OBSERVE (1.0) function. Through the action feedback process, some of the events detected by SENSE (S.0) can be anticipated or recognized as having been caused by the ACT (A.0) function. The spatial/temporal synchronization provides the means for determining the correct current tactical picture.

A.R RECEIVE COMMANDS

A.R.1 From EXECUTE (4.0)

Specific Commands for Implementation

A.1 IMPLEMENT COMMANDS

This function represents the execution of specific actions in response to commands and tasks.

A.1.1 Set Equipments

A.1.2 Actuate Weapons and Countermeasures

A.1.3 Operate Sensors

A.1.4 Control Platforms

A.1.5 Energize Simulators/Stimulators

A.2 GENERATE ACTION FEEDBACK

This function provides feedback for the OBSERVE (1.0) function within a given organizational level as to the status of actions by effectors occurring during the ACT (A.0) process. In this function, an expectation is provided for some of the event data in the SENSE (S.0) function.

A.3 SYNCHRONIZE ACTION

This function provides for organizational spatial/temporal synchronization that is used as a common reference between action and event data.

A.I ISSUE ACTIONS AND FEEDBACK DATA

A.I.1 To OBSERVE (2.0)

Data for Command Feedback

A.I.2 To SENSE (S.0)

Data for Temporal Synchronization

A.I.3 Effector Actions

On the Environment, etc.

TD ABSTRACTS

Vol. 1: The Hierarchy of Objectives approach to the specification of Command and Control warfare requirements is presented.

Keywords: C3I Analysis
Requirements Analysis

Vol. 2: A hierarchical multi-level analysis structure of functions and metrics is presented which relates Operational Functions and Resource Capabilities to Mission Success Criteria, Required Capabilities and Force Performance Measures.

Keywords: C3I Analysis
Requirements Analysis

Vol. 3: A hierarchical multi-level analysis structure is applied to functional and metric analysis at the system level (for this study, C3I systems).

Keywords: C3I Analysis
Requirements Analysis

CP Model: The conceptual Command Process Model is described. It provides a framework for the description of the military decision process to be used in the development of top-level warfare requirements and the assessment of Navy C3I systems.

Keywords: C3I Analysis
Requirements Analysis
Decision Process

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